

## A NEW FOSSIL NICOLETIIDAE (ZYGENTOMA, “APTERYGOTA”) IN DOMINICAN AMBER

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*Abstract.*—*Hemitrinemura exstincta*, n. sp., is described from Dominican amber (ca. 15–45 Ma). The new species is considered to be the only Neotropical representative of a genus with (?) three living species known from Papua New Guinea, Melanesia, and Polynesia. This species is the third Nicoletiidae fossil from New World amber; it is easily distinguishable from previously described taxa (two species of *Trinemurodes* Silvestri) by the complete praetarsus.

*Key Words:* biogeography, Dominican amber, *Hemitrinemura exstincta*, Nicoletiidae, Zygentoma

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Several specimens of Microcoryphia (= Archaeognatha) and Zygentoma (= Thysanura s. s.) have been described from Dominican amber. These include a single species of Meinertellidae (Microcoryphia), *Neomachilellus (Praeneomachilellus) dominicanus* Sturm and Poinar (1997) represented by a large number (ca. 100) of specimens, 3 specimens of *Ctenolepisma electrans* Mendes (1998) in the Lepismatidae (scaled and with lateral compound eyes), 11 specimens of *Archeatelura sturmi* Mendes (1997a, b) in the Ateluridae (eyeless, usually scaled, with short, droplike body and as a rule short appendages), and two species of Nicoletiidae (eyeless, usually unscaled, with thin elongate body and with long appendages), including one individual each of *Trinemurodes antiquus* Sturm and Mendes (1998) and *T. miocenicus* Sturm and Mendes (1998). A myrmecophilic relationship was suggested with *A. sturmi* since ants were also present in one of the amber pieces of that series (Mendes 1997b). The other

fossil taxa probably had edaphic (soil and/or soil surface) habits similar to their extant relatives.

The present fossil specimen is readily distinguishable from *Trinemurodes* Silvestri, the only previous genus of the Nicoletiidae described from Dominican amber, by its complete praetarsus with well-developed paired claws and empodium. The occurrence of this new fossil species is quite interesting not only from the systematic point of view but also because of its geographical origin and the distribution of its closest living relatives.

### MATERIALS AND METHODS

The specimen was obtained from mines in the Cordillera Septentrional of the Dominican Republic. Dating Dominican amber is still controversial with the latest proposed age of 20–15 mya based on Foraminifera (Iturralde-Vincent and MacPhee 1969) and the earliest as 45–30 mya based on coccoliths (Cêpek in Schlee 1990). A

range of ages for Dominican amber may be likely since the amber fossils are associated with turbiditic sandstones of the Upper Eocene to Lower Miocene Mamey Group (Draper et al. 1994). Dominican amber can be secondarily deposited in sedimentary rocks, which makes a definite age determination difficult (Poinar and Mastalerz 2000). Dominican amber was produced by the leguminous tree, *Hymenaea protera* Poinar (1991). A re-construction of the Dominican amber forest based on amber fossils indicated that the climate was similar to that of a present-day tropical moist forest (Poinar and Poinar 1999). The amber piece containing the fossil was reshaped and polished in order to better view the specimen. Examination was made under magnifications of up to 750 $\times$ , with a combination of direct illumination (optical tubes of Hund Wetzler apparatus) and indirect lighting (with a Leitz SM-Lux optical microscope and a Wild M5A stereoscopic microscope). Also included in the same amber piece with the nicoletiid were various sized pieces of plant material. The holotype and only specimen is deposited in the Poinar Amber Collection maintained at Oregon State University (accession # T-1-13).

#### DESCRIPTION

### *Hemitrinemura exstincta* Mendes and Poinar, new species (Figs. 1–16)

**Diagnosis.**—The new species possesses a long, thin, parallel-sided body with only setae and macrochaetae (scales lacking), a developed protheca, simple and complete praetarsi with long, delicate, smooth claws; thin tibiae with some long, stout, spiniform ventral setae; a short and wide urotergite X; urosternites I (?)–VII entire, II–IX stylets and II–VII vesicular structures; a subgenital plate wider than long; a short typical ovipositor with thin setae only and a spinulated inner ventral area of gonapophyses IX. The new species is distinguished from other species of the genus by the degree of ap-

pendage elongation. It is intermediate between the very elongated *H. subarmata* (Paclt), from Papua New Guinea (Paclt 1982), and the short, stout forms of *H. pacifica* (Carpenter) from Samoa (Polynesia) and Vanuatu (Melanesia) archipelagos and *H. gracilis* (Carpenter) from Western Samoa (Carpenter 1928).

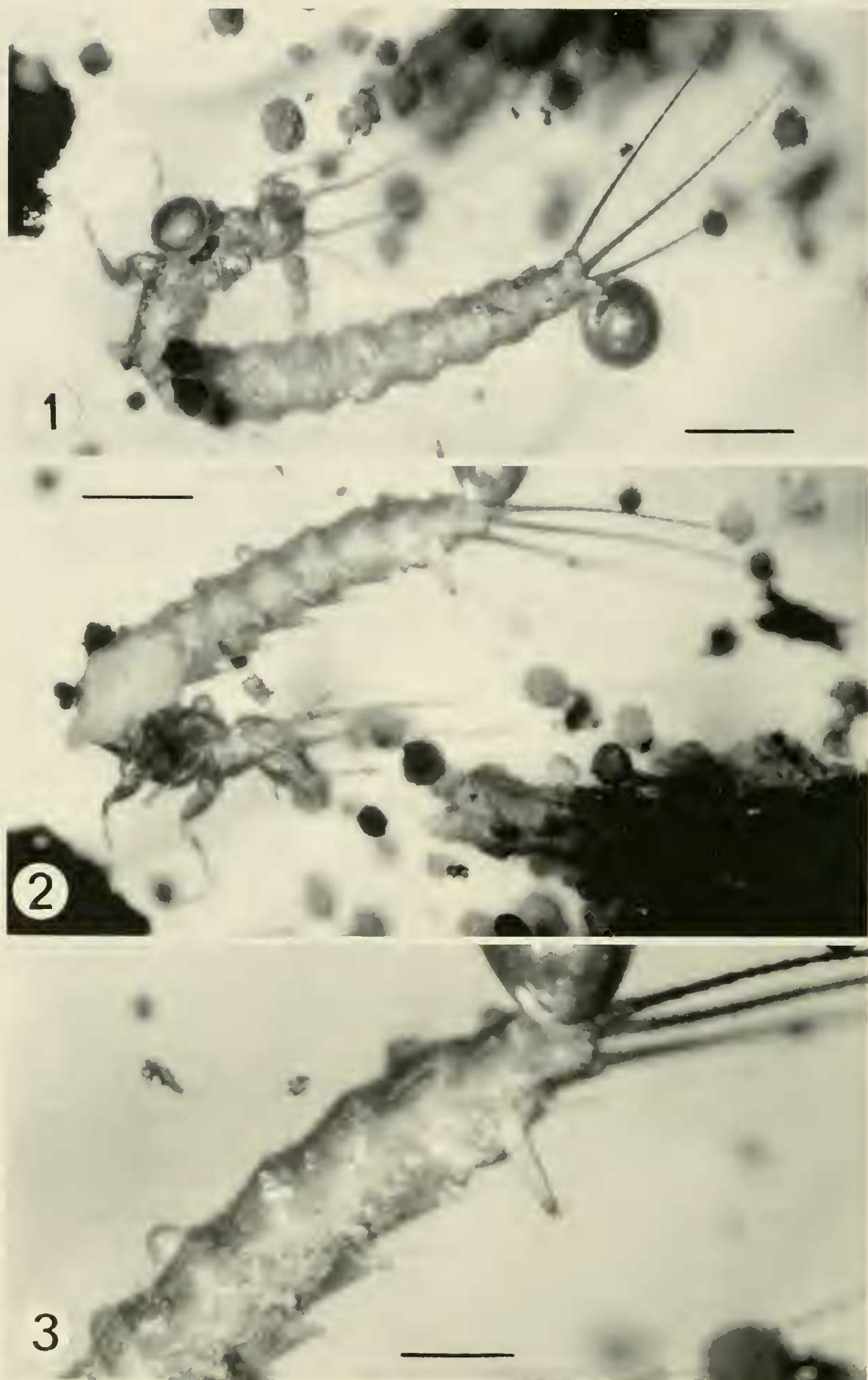
**Description.**—The basal ventral portion of the abdomen is damaged and the body is twisted in a U shape position. Some air bubbles and minute opaque particles occur on the dorsolateral surface at the end of the abdomen, at the middle dorsal area of the thorax and along the body. Some areas are either deformed or difficult to study in detail due to the position of the specimen.

*Body length:* 4.1 mm; antennae length: maximum of 3.1 mm; cerci length: 2.3 mm; paracercus length (apically damaged): 2.4 mm.

*Body* (Figs. 1–4): Thin and elongate, delicate, lacking scales; setae and macrochaetae present, some near the border of the sclerites; legs long and stout, with acute or round points.

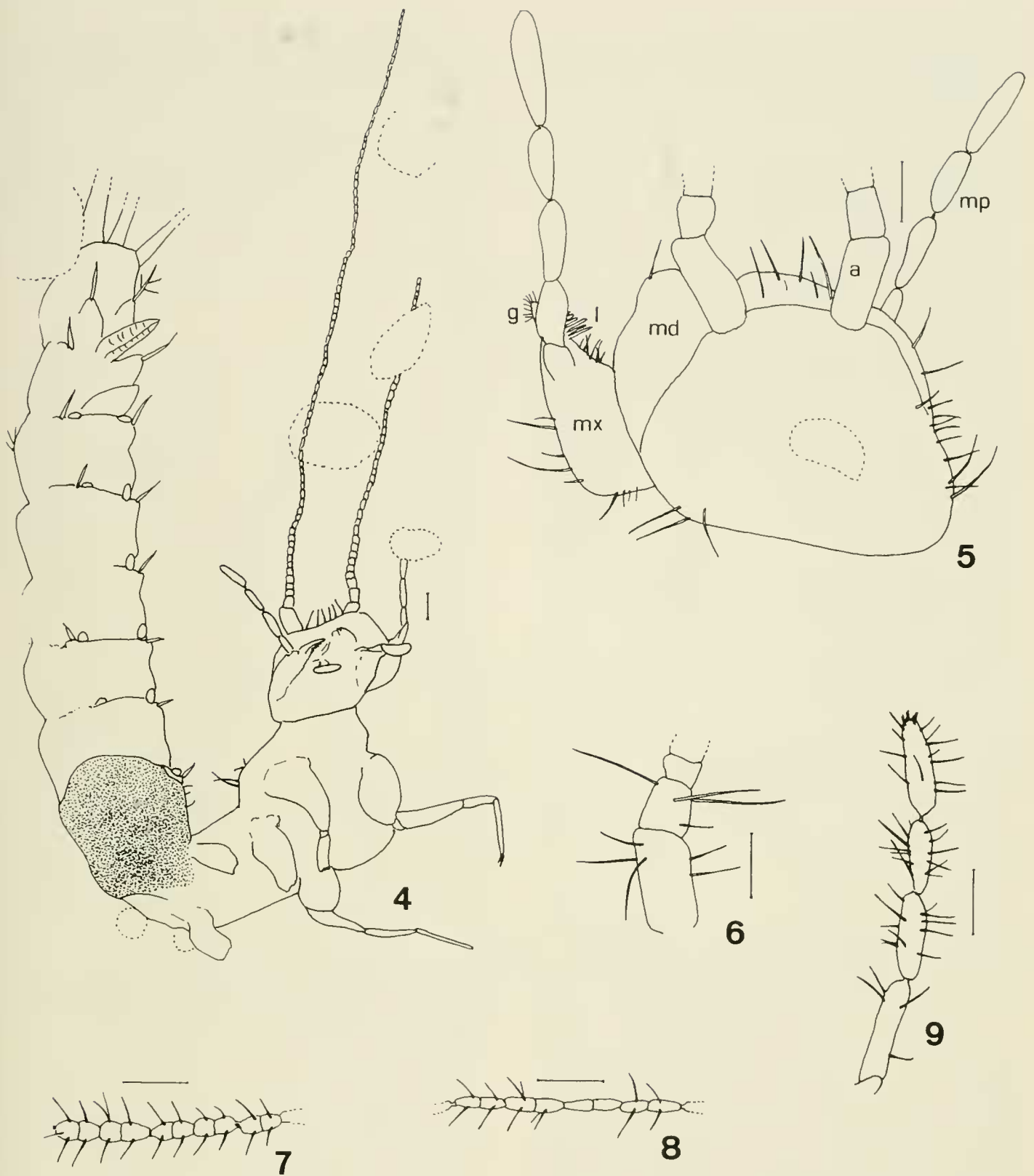
*Head* (Figs. 4–9): Almost certainly wider than long (oblique) with several macrochaetae mainly along lateral and posterior borders; antenna typical, scapus subcylindrical, ca. twice as long as wide, pedicellus not much longer than wide; flagellum with ovoid articles, each with a ring of thin setae, those of basal area round, apical ones clearly longer than wide; mandible large, apex not visible in detail; maxilla with protheca, lacinial teeth acute, dark; galea ?; maxillary palp with subcylindrical articles, apical one with 6 papillae, ca. .25 longer than preceding and ca. 3.2 times longer than wide; labial posterolateral area not visible, labial palp (only one preserved) close to amber surface, impossible to see in detail, its apical article apparently ovoid or trianguloid and more or less as long as wide, with usual papillae.

*Thorax* (Figs. 10–11): Longer than wide, with several marginal macrochaetae and some smaller discal setae and macrochae-



Figs. 1-3. *Hemitrinemura extincta*, holotype. 1, Dorsal view, scale bar: 860  $\mu$ m. 2, Ventral view, scale bar: 860  $\mu$ m. 3, Detail of abdomen, scale bar: 480  $\mu$ m.





Figs. 4–9. *Hemitrinemura extincta*, holotype. 4. Ventral surface; damaged area of basal abdomen dotted, the air bubbles and granules in broken lines. 5. Head, dorsal. 6. Scapus and pedicellus of antenna. 7. Median flagellar chain. 8. Distal flagellar chain. 9. Maxillary palp. Scale bar: 0.1 mm. Abbreviations: a, antenna; g, galea; l, lacinia; md, mandible; mp, maxillary palp; mx, maxilla.

tae; leg I and leg II of only left side present and exclusively first one complete (right leg I and leg II and both leg III missing, only coxae preserved); femur of leg I and leg II elongate, thin (almost certainly distorted), tibiae very delicate, with short setae and

ventral macrochaetae; tibia I ca.  $\frac{1}{3}$  shorter than tibia II; tarsi with 4 divisions, with some strong ventral setae, praetarsus simple and complete, with long, thin lateral claws and delicate empodium (similar to claws though smaller, thinner and less arched);

tibia I, 0.16 mm long, clearly shorter than tarsus, tibia II, 0.26 mm, as long as tarsus.

*Abdomen* (Figs. 12–16): Tergites similar to nota, with short setae and some posterior elongate macrochaetae (3+3 on posterolateral angle of urotergites I–VIII); urotergite X very short and wide, with almost straight posterior border (macrochaetae not preserved); urosternite I polished away from amber piece, II–VII entire; II–VI with vesicles, VII with pseudovesicles; II–IX with short, delicate, stylets; urostylet IX longer and stouter (ca. 0.20 mm) than urosternite VIII (ca. 0.14 mm), with some spiniform dark, long setae more conspicuous on IX; setae and macrochaetae of urosternites impossible to observe; subgenital plate elliptical, shorter than wide at base; ovipositor short, with 8–10 divisions and with thin setae only, preserved in distorted position; inner ventral area of gonapophyses IX with spinulated integument; cercus and paracercus elongate, robust, clearly longer than half body length, with short setae and strong, elongate, macrochaetae.

*Etymology*.—From the Latin *extinctus* (*a*) (*um*), killed, disappeared, suppressed, extinct, in allusion to its fossil existence.

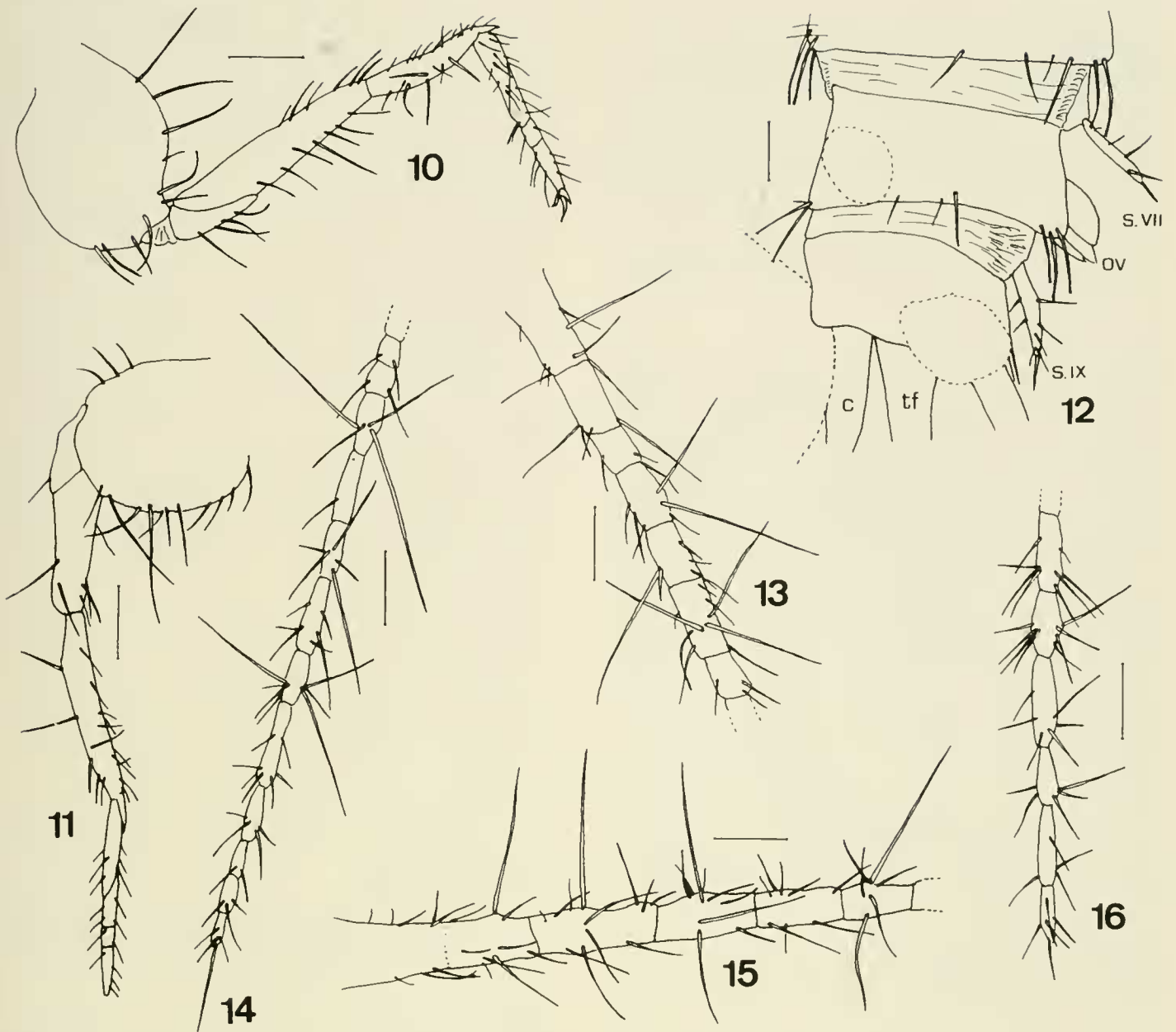
*Discussion*.—The new taxon clearly shows a developed prostheca and subgenital plate and distally transformed gonapophyses IX integument, which removes it from the Protrinemurinae. The presence of entire urosternites II–VII excludes it from the Nicoletiinae as well as the Cubacubaninae. Unfortunately, the first urosternite is damaged, which makes it impossible to state accurately if this sclerite is entire (as occurs with the Subnicoletiinae) or if it is composed of one median sternite plus 1+1 coxites (as typical of the Coletiniinae) (Mendes 1988, 1994).

The occurrence of 8 pairs of abdominal stylets (II–IX) and vesicular structures on urosternites II–VII is typical for the type genus, *Coletinia* Wygodzinsky 1980. However, this predominantly northern Mediterranean genus possesses a much longer ovipositor (exceeding the length of the IX sty-

lets), a longer and more or less emarginated X urotergite and much more robust tibiae. Furthermore, the male paramera of *Coletinia* are entire and the ventral surface of X urotergite bear typical pegs, in contrast to the condition in Subnicoletiidae. In spite of the damaged urosternite I and absence of secondary sexual characteristics, we believe the Dominican amber fossil belongs to the Subnicoletiinae.

The Subnicoletiinae (based on Mendes 1988, 1994 and Smith 1998) consists of 10 genera with a typical Gondwanian distribution known exclusively from the Southern continents. The only genus in the family with living and fossil representatives (Sturm and Mendes 1998) is *Trinemurodes* Silvestri 1916, recognized by the absence of empodia. A lepismatoid-shaped body is also shared by other genera tentatively placed in this subfamily, including *Hematelura* Escherich 1906, with modified scales, 4–6 pairs of vesicles and a Gondwanian distribution, *Trichatelura* Silvestri 1932, from the Neotropics, with 3 pairs of stylets, *Trichotriura* Silvestri 1918 and *Trichotriuroides* Mendes et al. 1994 from Western Central Africa, with a reduced number of stylets (also on VII–IX only) and distinct tergal chaetotaxy.

*Subnicoletia* Silvestri 1908a, a poorly described monotypical genus from the Guinea Gulf island of São Tomé (São Tomé a Príncipe Republic), has the stylets from urosternites IV–IX reduced to 6 pairs. The Australian genera *Trinemura* Silvestri 1908b and *Subtrinemura* Smith 1998, though much more similar to the fossil, show abdominal stylets on the urosternites III–IX (lacking on II) as does *Mettrinura* Mendes 1994, known from Australia and Celebes (= Sulawesi) with one isolated species in Colombia. *Hemitriemura* Mendes 1994 is the only described genus that shares similar characters with the new Dominican fossil species, namely a long, thin unscaled body, entire urosternites (from I–VII), abdominal stylets on II–IX, vesicles on II–VI, pseu-



Figs. 10–16. *Hemitrinemura extincta*, holotype. 10, Left leg I, ventral. 11, Left leg II, ventral. 12, Dorsal posterior abdomen. 13, Right cercus, dorsal, basal area. 14, Right cercus, distal area. 15, Terminal filament dorsal, basal area. 16, Terminal filament, distal area. Scale bar: 0.1 mm. Abbreviations: c, cercus; ov, ovipositor; s.VIII, stylet VIII; s.IX, stylet IX; tf, terminal filament.

dovesicles on VII, and a complete praetarsus, with paired claws plus empodium.

According to Smith (1998), *Hemitrinemura* includes not only the type species, *H. subarmata* (Paclt), from Papua New Guinea (Paclt 1982), but also two other species considered as possibly conspecific (Smith 1998), namely *H. pacifica* (Carpenter) from Samoa (Polynesia) and Vanuatu (Melanesia) archipelagos and *H. gracilis* (Carpenter) from Western Samoa (Carpenter 1928). As previously reported (Smith 1998) the Pacific representatives show “antennae much shorter than body total length” and

“legs short and stout,” which seems to indicate a much closer similarity between *H. subarmata* (Paclt) and *H. extincta* sp.n. Indeed, both species show quite thin and elongate legs and, despite the incomplete flagellar chain in the Dominican fossil, thin and elongate antennae. *Hemitrinemura subarmata*, probably a troglobiont, is known only by males (Paclt 1982, Smith 1998). While the newly described species consists of one unique female; the New Guinea specimens are much larger (body + head ca. 10 mm), show longer and thinner maxillary palp articles and lack strong elongate



spines on the ventral surface of the legs. Despite possible shrinking resulting from amber preservation and even taking into account that both males of *H. subarmata* are almost certainly somewhat distorted by dehydration as reported by both Paclt (1982) and Smith (1998), the dissimilar characters show that *H. exstincta* is distinct from the New Guinea species.

This is one of the few Dominican amber fossils with extant relatives having an Indo-West Pacific distribution. A Dominican amber marine water strider, *Halovelina electrodominica* Andersen and Poinar (1998) also had a similar disjunct distribution with extant members of the genus occurring in the Indo-West Pacific Region. Discovering a species of *Hemitrinemura* in Dominican amber suggests that the genus had a much more extensive distribution, including trans-Pacific, in the mid-Tertiary. The extinction of *H. exstincta* from the New World could have been the result of climatic changes associated with cooling events that occurred in the Caribbean during the Pliocene-Pleistocene periods, a condition that probably resulted in the extinction of many clades found in Dominican amber (Poinar and Poinar 1999).

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